# *Pension Reserves Investment Management Board*

# *Assessment of the Funded Status of the Commonwealth of Massachusetts Retirement Systems*


***Prepared by***

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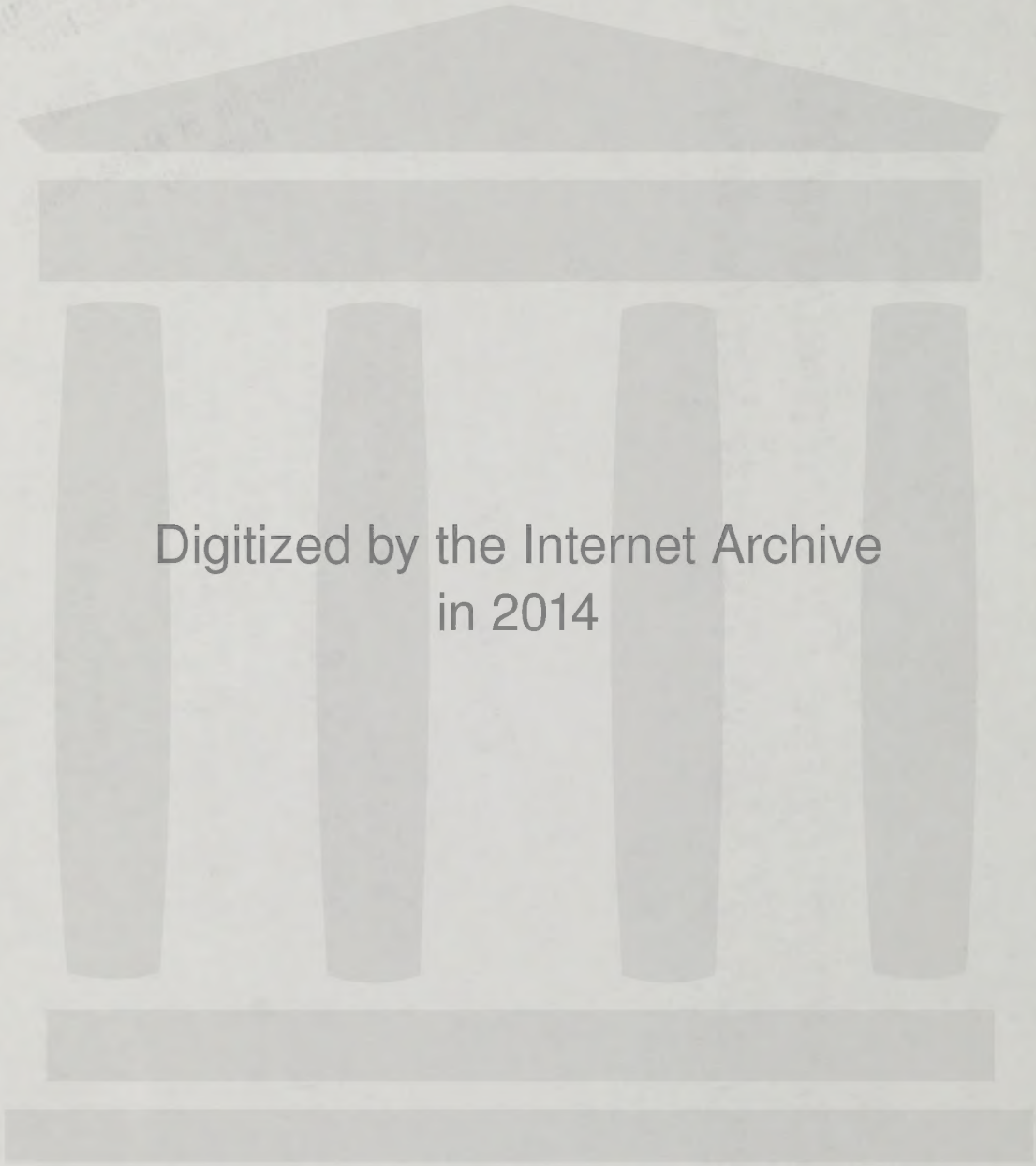

### *M&R's Assignment*

Perform an independent assessment of the funded status of the following Commonwealth of Massachusetts Retirement Systems, each of which is a component of the Commonwealth's total pension liability:

- State Employees Retirement System ("SERS")
- State Teachers Retirement System ("Teachers")
- City of Boston Teachers Retirement System ("Boston Teachers")

An assessment of the Local COLA Obligations of the Massachusetts Retirement System was not performed because the liability is relatively small and the required analysis relatively complex.

***Process***

- Review and, to the extent possible, replicate PERAC's January 1, 1998 Valuation
- Review PERAC's economic actuarial assumptions
- Review PERAC's demographic assumptions
- Test those assumptions by means of an "experience study"
- Project resulting funded ratios to January 1, 1999 and June 30, 1999
- Test data reliability

## *Findings – Replication of PERAC's January 1, 1998 Valuation*

Our calculations to replicate the results of PERAC's January 1, 1998 valuation indicate that the Commonwealth's total Actuarial Liability was 72.6% funded based on the actuarial assumptions and asset values PERAC used to prepare that valuation. This is 5.6% less than the 78.2% funded ratio reported by PERAC in its January 1, 1998 actuarial valuation report. Our results are summarized in the following table. We are also showing the funded status based on the market value of assets.

| *$ amounts in millions* | *SERS* | *Teachers* | *Boston Teachers* | *Local COLA ** | *Total* |
|---|---|---|---|---|---|
| ***Actuarial Liability*** | $ 12,380.6 | $ 14,049.4 | $ 1,282.8 | $ 912.0 | $ 28,624.8 |
| ***Funded Status based on Actuarial Value of Assets*** | | | | | |
| (PERAC's basis for measuring funded status for 1998; AVA = 97% of MV) | | | | | |
| ***Assets – Actuarial Value*** | 9,914.0 | 10,170.0 | 699.5 | 0.0 | 20,783.5 |
| ***Unfunded Liability*** | 2,466.6 | 3,879.4 | 583.3 | 912.0 | 7,841.3 |
| ***Funded Ratio*** | 80.1% | 72.4% | 54.5% | 0.0% | 72.6% |
| ***Funded Status based on Market Value of Assets*** | | | | | |
| (alternative basis for measuring funded status) | | | | | |
| ***Assets – Market Value*** | 10,220.6 | 10,484.5 | 721.1 | 0.0 | 21,426.2 |
| ***Unfunded Liability*** | 2,160.0 | 3,564.9 | 561.7 | 912.0 | 7,198.6 |
| ***Funded Ratio*** | 82.6% | 74.6% | 56.2% | 0.0% | 74.9% |

* Figures from PERAC's 1998 valuation report; M&R did not prepare an independent estimate of this liability.

The differences between M&R's results and PERAC's results are attributable to deficiencies in the old actuarial valuation software PERAC used for its January 1, 1998 valuation. (We understand that PERAC had decided, prior to when M&R was retained by PRIM, to upgrade its software, and that the new PERAC software is producing results close to the values we calculated.)

## *Findings - Review of Economic Actuarial Assumptions*

M&R reviewed the economic assumptions used by PERAC in light of:

- the investment strategy of PRIM
- historical data regarding price and wage inflation
- actual salary data used in the 1995, 1996 and 1998 actuarial valuations
- Actuarial Standard of Practice - *Selecting Economic Assumptions for Measuring Pension Obligations* (ASOP No. 27)

Based on this review, we concluded that the 8.25% investment return assumption is a reasonable, slightly conservative assumption. We agreed that a 3% assumed rate of price inflation is reasonable. In our analysis of the actual valuation salary data, we observed a pattern of higher salary increases during the early years of service than during the later years. We therefore modified the PERAC assumption of 6% for all years of service to reflect this pattern. M&R's salary growth assumption varies by group and starts with the "first year rate" shown in the table below. For each subsequent year of service, the rate is decreased by 0.25% to an ultimate salary growth rate of 4.5%.

| ***Group*** | ***First Year of Service Rate*** |
|---|---|
| Group 1 other than Teachers | 8.50% |
| Teachers | 8.00% |
| Group 3 (State Police) | 9.00% |
| Group 4 (other Hazardous Duty) | 7.50% |

This salary growth assumption change ***decreased*** the January 1, 1998 Actuarial Liability by $1.7 billion.

***Findings – Review of Demographic Actuarial Assumptions***

Our primary objective was to study the three Systems' patterns of turnover and retirement. In order to accomplish this, we needed to identify the active members who left during the study period and break them down into three groups: (1) those who terminated, (2) those who retired, and (3) those who died or became disabled. However, limited data was available regarding the cause of termination. For some active members, the cause of their departure (i.e., termination, retirement, death or disability) was indicated, but for many other members, no information was available other than the fact that they had been active at one point in the study period and were not active as of a later point. In order to proceed, we estimated the number of deaths and disabilities based on PERAC's actuarial assumptions used for its January 1, 1998 valuation.

Based on this data, we then studied patterns of rates of retirement and terminations during the three years for which data was available (1995-1998), and developed revised retirement and termination assumptions as follows:

- SERS – We modified PERAC's assumptions by weighting M&R's analysis of the experience during the 3 year study period by 50% and PERAC's 1998 assumptions by 50%.
- Teachers – M&R's analysis of the experience during the 3 year study period found that the experience was closer to the assumptions developed by EFI Actuaries[i] based on 1990-1994 experience than to PERAC's 1998 assumptions. Therefore, we developed assumptions which reflected the combined 8 years of experience studied by EFI Actuaries and M&R.
- Boston Teachers – M&R's analysis of the experience during the 3 year study period found that the experience differed significantly from PERAC's 1998 assumptions. Accordingly, we developed assumptions for Boston Teachers by averaging Boston Teachers experience during the 3 year study period with the State Teachers assumptions developed by EFI Actuaries.

These demographic assumption changes ***increased*** the January 1, 1998 Actuarial Liability by $3.5 billion.

No data was available for us to review mortality among retired members. Accordingly, for retired Teachers (both State and Boston) we relied on experience data studied by EFI Actuaries to establish a life expectancy assumption for members in pay status. This indicated that the 1994 GAM mortality table represented actual experience among retired teachers during 1990-1994. For the State Retirement System, we selected the most recent mortality study prepared by the Society of Actuaries, the UP 1994 Table. To make some provision for expected continued mortality improvements, we projected each of these tables to 2009 – ten years beyond the valuation date.

This change in the post-retirement mortality assumption ***increased*** the January 1, 1998 Actuarial Liability by $1 billion.

With respect to the other actuarial assumptions, we generally chose to continue the use of PERAC's assumptions because there was insufficient data available from which to form an opinion with respect to anticipated future experience.

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[i] On behalf of the Massachusetts Teachers' Retirement Board, EFI Actuaries prepared a report entitled "An Actuarial Appraisal of Retirement Alternatives and Other Enhancements" dated December 14, 1996. This report included an experience study based on teacher data for the period, January 1, 1990 through December 31, 1994.

## *Findings – Funded Status as of January 1, 1998 based on revised actuarial assumptions*

The results of applying the revised actuarial assumptions described above on the funded status of the Systems as of January 1, 1998 (the date of the most recent PERAC actuarial valuation report) are shown below.

| *$ amounts in millions* | *SERS* | *Teachers* | *Boston Teachers* | *Local COLA ** | *Total* |
|---|---|---|---|---|---|
| ***Actuarial Liability*** | $ 13,461.2 | $ 15,597.6 | $ 1,416.6 | $ 912.0 | $ 31,387.4 |
| ***Funded Status based on Actuarial Value of Assets*** (PERAC's basis for measuring funded status for 1998; AVA = 97% of MV) | | | | | |
| ***Assets – Actuarial Value*** | 9,914.0 | 10,170.0 | 699.5 | 0.0 | 20,783.5 |
| ***Unfunded Liability*** | 3,547.2 | 5,427.6 | 717.1 | 912.0 | 10,603.9 |
| ***Funded Ratio*** | 73.6% | 65.2% | 49.4% | 0.0% | 66.2% |
| ***Funded Status based on Market Value of Assets*** (alternative basis for measuring funded status) | | | | | |
| ***Assets – Market Value*** | 10,220.6 | 10,484.5 | 721.1 | 0.0 | 21,426.2 |
| ***Unfunded Liability*** | 3,240.6 | 5,113.1 | 695.5 | 912.0 | 9,961.2 |
| ***Funded Ratio*** | 75.9% | 67.2% | 50.9% | 0.0% | 68.3% |

* Figures from PERAC's 1998 valuation report; M&R did not prepare an independent estimate of this liability.

## *Findings – Projection of Results to January 1, 1999*

We initially planned to reflect changes in the demographic makeup of the Systems' membership in projecting the results from January 1, 1998 forward in time. However, summary information regarding the census data for the January 1, 1999 actuarial valuation is not yet available. We have based our projection on the assumption that changes in the membership have occurred as predicted by our revised actuarial assumptions and that the number of active members remained constant while total payroll grew at 4.5% per year, the assumed rate of wage inflation.

| *$ amounts in millions* | *SERS* | *Teachers* | *Boston Teachers* | *Local COLA ** | *Total* |
|---|---|---|---|---|---|
| ***Actuarial Liability*** | $ 14,599.5 | $ 16,745.7 | $ 1,514.0 | $ 912.0 | $ 33,771.2 |
| ***Funded Status based on Actuarial Value of Assets*** | | | | | |
| (PERAC's basis for measuring funded status for 1999; AVA = 94% of MV) | | | | | |
| ***Assets – Actuarial Value*** | 11,164.9 | 11,428.6 | 799.4 | 0.0 | 23,372.9 |
| ***Unfunded Liability*** | 3,434.6 | 5,317.1 | 734.6 | 912.0 | 10,398.3 |
| ***Funded Ratio*** | 76.5% | 68.2% | 51.5% | 0.0% | 69.2% |
| ***Funded Status based on Market Value of Assets*** | | | | | |
| (alternative basis for measuring funded status) | | | | | |
| ***Assets – Market Value*** | 11,877.6 | 12,158.1 | 829.1 | 0.0 | 24,864.8 |
| ***Unfunded Liability*** | 2,721.9 | 4,587.6 | 684.9 | 912.0 | 8,906.4 |
| ***Funded Ratio*** | 81.4% | 72.6% | 54.8% | 0.0% | 73.6% |

* Figures from PERAC's 1998 valuation report; M&R did not prepare an independent estimate of this liability.

## *Findings – Projection of Results to June 30, 1999*

We also projected the Actuarial Liabilities to June 30, 1999, again assuming that terminations would be in accord with the actuarial assumptions developed for this study, that the number of active members would remain constant, and that total payroll would grow at an annual rate of 4.5% (2.25% over the 6-months).

| *$ amounts in millions* | *SERS* | *Teachers* | *Boston Teachers* | *Local COLA ** | *Total* |
|---|---|---|---|---|---|
| ***Actuarial Liability*** | 15,150.5 | 17,333.8 | 1,565.1 | 912.0 | 34,961.4 |
| ***Funded Status based on Actuarial Value of Assets*** | | | | | |
| (PERAC's basis for measuring funded status for 1999; AVA = 94% of MV) | | | | | |
| ***Assets – Actuarial Value*** | 12,175.6 | 12,488.8 | 813.9 | 0.0 | 25,478.4 |
| ***Unfunded Liability*** | 2,974.9 | 4,845.0 | 751.2 | 912.0 | 9,483.0 |
| ***Funded Ratio*** | 80.4% | 72.0% | 52.0% | 0.0% | 72.9% |
| ***Funded Status based on Market Value of Assets*** | | | | | |
| (alternative basis for measuring funded status) | | | | | |
| ***Assets – Market Value*** | 12,952.8 | 13,286.0 | 865.9 | 0.0 | 27,104.7 |
| ***Unfunded Liability*** | 2,197.7 | 4,047.8 | 699.2 | 912.0 | 7,856.7 |
| ***Funded Ratio*** | 85.5% | 76.6% | 55.3% | 0.0% | 77.5% |

* Figures from PERAC's 1998 valuation report; M&R did not prepare an independent estimate of this liability.

***Determining the Actuarial Value of Assets***

Effective with the January 1, 1998 Actuarial Valuation Report, PERAC implemented a change from using the market value of assets to using an actuarial value of assets for determining the Commonwealth's contributions and for reporting the funded ratios. This change in methodology was made in order to allow investment gains and losses to be phased in over several years. This reduces the potential for unstable contributions due to market volatility. PERAC's report does not contain a description of their method for determining the actuarial value of assets. Thus we are unable to comment on their specific method.

M&R agrees that using an actuarial value of assets (AVA) is appropriate for this purpose. There are many accepted ways to determine the AVA. PERAC's January 1, 1998 report states that the AVA was determined to equal 97% of the market value of assets. For the January 1, 1999 Actuarial Valuation Report, we understand that PERAC will be using 94% of the market value for the AVA.

M&R has compared PERAC's 97% and 94% adjustments by developing an AVA using two commonly used methods. For the 1998 valuation, the range for the AVA would be 90% - 94% of the market value. For 1999, the range for the AVA would be 87% - 93% of the market value. PERAC is transitioning to the use of an AVA. If either of these two commonly used methods of determining the AVA were utilized, the funded levels would be further lowered.

There are a few items of note:

- We typically review five years of membership data when undertaking an actuarial review of assumptions. In this case, however, PERAC only provided the data used in the following actuarial valuations: 1998, 1996, and 1995.
- We obtained information on a sample of newly retired members from each of the three Systems. Our review of this information indicates that there are a number of material inconsistencies between the salary and service data used to calculate retirement benefits and the salary and service data provided to PERAC for their valuation.
- We have relied throughout our study on the liability figures for terminated vested and terminated nonvested members reported by PERAC in their January 1, 1998 actuarial valuation. So little data is available with respect to these members or their benefits that we were not in a position to form an opinion with respect to the liability for this group.
- For the assets allocated to the Boston Teachers, we have relied on the methodology reported by PERAC in their January 1, 1998 actuarial valuation. Our understanding is that a determination was made based on PERA's January 1, 1994 valuation as to the percentage of overall City of Boston assets which are allocated to Boston Teachers. PERAC has continued to use this percentage (29.91%) without adjustment for cash flows subsequent to January 1, 1994. It is likely that this percentage would have changed, perhaps materially, during the 5 ½ years since January 1, 1994.